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Are Employees in Uranium Processing Operations at Greater Risk of Death From Lung Cancer than other DOE Workers?

A study published in the July 1995 issue of the journal Epidemiology (Volume 6, Number 4, pages 370-375), entitled "Uranium Dust Exposure and Lung Cancer Risk in Four Uranium Processing Operations," explored the risk of lung cancer in workers who received internal alpha radiation exposures from inhaling uranium dust. It included workers employed for 6 months or longer in uranium processing or fabrication operations at the Tennessee Eastman Corporation's (TEC) operation at the Y-12 Plant in Oak Ridge, Tennessee, 1943-1947; the Y-12 Plant operation, 1947-1983; two Mallinckrodt Chemical Works plants in Missouri, 1942-1966; and the Feed Materials Production Center in Ohio, 1951-1989.

Using information on death certificates, 787 workers were identified who died from lung cancer (study cases). For each case, one worker similar in race, gender, worksite, date of birth, and date of first hire was selected as a study control. Annual internal lung doses from uranium dust were estimated from available information, which varied by facility. At the Y-12 Plant during TEC operation, only air samples were taken. In the other operations, internal doses were estimated either from personal breathing zone monitors or from uranium whole-body counting or urinalysis. Since doses estimated from air samples were more uncertain than those derived by the other methods, risks were calculated separately for those who had worked only at TEC and those who had worked in other operations (but may have worked at TEC also).

Yearly doses were summed to get a total internal lung dose for each worker. Workers were grouped by total dose into seven categories, from doses less than 0.05 centigray (cGy) (the lowest dose group) to doses greater than 25.0 cGy (the highest dose group). (One cGy equals one rad and is a measure of the energy absorbed by human tissue, such as the lungs, as radiation particles travel through it.) Because cancer takes many years to develop, the authors omitted doses received within 10 years of death from their estimates of total dose. The risk of death from lung cancer was calculated by comparing deaths in each dose group with deaths in the lowest dose group. Since some workers were also exposed to radiation from other sources, such as thorium,

radium, and radon, and to external gamma radiation, the importance of these exposures was evaluated.

No increased risk of death due to lung cancer was detected for workers receiving internal doses less than 25.0 cGy. Non-TEC workers who received internal lung doses greater than 25.0 cGy appeared to have a twofold increased risk of death from lung cancer. However, this finding was based on only four deaths and was not statistically significant.

When the analysis was limited to those who were first hired at 45 years of age or older, there seemed to be an increased risk for workers in the three lowest dose categories, but no increased risk was found for workers in the highest dose group. These results were not statistically significant, and no dose-response effect was found (i.e., risk did not increase with increased dose).

Information on smoking, an important cause of lung cancer, was available for only 166 of the 787 case-control pairs. Looking only at those workers whose smoking habits were known and taking the effect of smoking into account, non-TEC workers in the low-dose category (0.05-0.25 cGy) and in a mid-level category (0.5-2.5 cGy) appeared to have an increased risk of death from lung cancer. These results also were not statistically significant.

An analysis that combined total lung doses from external and internal sources of radiation showed a very slight increase in risk with increasing external dose among those in the highest internal dose group. Again, this result was not statistically significant.

The authors concluded that this study found no dose-response relationship between lung cancer risk and radiation dose to the lung from internal exposure to uranium dust at the levels of exposure experienced by workers in these facilities. Limitations of this study included uncertainties in estimating internal lung doses, the lack of smoking information for all workers, and the small number of workers in the highest dose category.

The Department of Energy (DOE), in cooperation with the National Institute for Occupational Safety and Health, will continue to evaluate the health of its current and former employees and make these findings available to the public. For a copy of this article from the journal of Epidemiology, check with your local DOE reading room or contact the Office of Epidemiologic Studies on 301-903-5328. For extra copies of the Health Bulletin, please contact the Office of Epidemiologic Studies on 301-903-5328.

This Health Bulletin is one in a series of routine publications issued by the Office of Health Studies to share data from health studies throughout the DOE complex. The authors' conclusions do not necessarily reflect those of the Department. For more information contact: Lynn E. Judson, Office of Epidemiologic Studies, U.S. Department of Energy, Washington,

D.C. 20585; Telephone (301) 903-1797.